

PCT

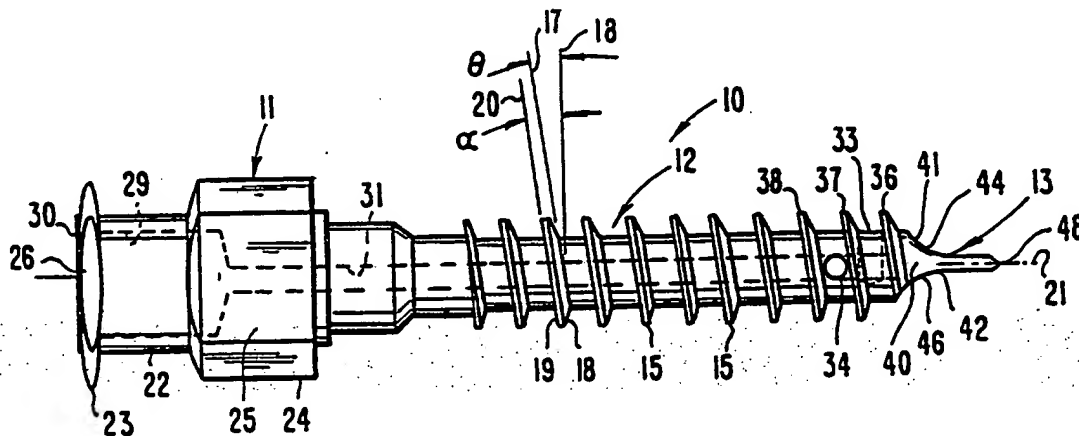
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US89/04715 (22) International Filing Date: 23 October 1989 (23.10.89)  (30) Priority data: 261,699                      24 October 1988 (24.10.88)      US  (71) Applicants: COOK INCORPORATED [US/US]; 925 South Curry Pike, P.O.Box 489, Bloomington, IN 47402 (US); UNIVERSITY OF FLORIDA [US/US]; 223 Grinter Hall, Gainesville, FL 32611 (US).  (72) Inventors: MELKER, Richard, J. ; 6101 Northwest 19th Place, Gainesville, FL 32605 (US). GEAREN, Peter, F. ; 2800 Southwest 1st Way, Gainesville, FL 32601 (US). MILLER, Gary, J. ; 531 Southwest 26th Place, Gainesville, FL 32601 (US). DeBRUYNE, Michael, P. ; 3270 Braeside Drive, Bloomington, IN 47401 (US). MOLLITOR, Lisa ; 2800 Southwest 1st Way, Gainesville, FL 32601 (US).		(74) Agents: EMHARDT, C. David et al.; Woodard, Emhardt, Naughton, Moriarty & McNett, One Indiana Square, Suite 2000, Indianapolis, IN 46204 (US).  (81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).  Published <i>With international search report.          Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: INTRAOSSEOUS NEEDLE ASSEMBLY



(57) Abstract

An intraosseous needle assembly includes an intraosseous needle (10) having a threaded shaft (12) with a passageway extending substantially therethrough, a solid and pointed tip (13) at one end thereof, the tip having a pair of concave indentations (41), (42), creating cutting edges. At the opposite end of the shaft, or hub, the needle is adapted to couple with an appropriate gripping device. A handle is provided in the shape of a ball knob and is adapted to telescopically and grippingly receive the hub (11) of the needle. The hub and handle are both equipped with mutually engaging torque-transmitting surfaces.

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INTRAOSSSEOUS NEEDLE ASSEMBLYField of the Invention

The present invention relates to infusion needles, and more particularly, to an intraosseous infusion needle assembly having a tip adapted to bore directly into the patient's bone.

Background of the Invention

In a variety of medical emergencies, the patient's life may hinge upon the ability of the physician or medical attendant to administer a particular fluid into the patient's bloodstream. In emergency situations such as on the battlefield, at traffic accident scenes or in the emergency room, the patient is often in shock, has low blood pressure, is bleeding profusely and may be thrashing about. Under such circumstances, finding and gaining access to a suitable blood vessel can be all but impossible, the resulting delay in administering drugs to the patient possibly being fatal. In the case of children or infants in any emergency, even the largest veins are so small that they may not be located. Even if located, an infant's largest available vein may be so small that stable infusion access may not be possible.

One alternative to venous access, recently reintroduced, is the intraosseous route. The medullary cavity of the long bones is composed of a rich spongy network of venous sinusoids which drain into a central venous canal. Blood then exits the venous canal by nutrient or emissary veins

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into the circulation. Fluids or drugs injected into the medullary area usually diffuse only a few centimeters, enter the bloodstream and reach the heart--all in only about 10 seconds from injection into the medullary cavity. The

5 current intraosseous infusion procedure uses a hollow needle having a beveled top and a trocar or stylet. With the stylet telescopically positioned within and extending partially out the bevelled end of the needle, the needle and trocar assembly is forceably and perpendicularly advanced

10 against and through the desired bone until the cortex has been punctured and the needle and trocar tip has advanced into the medullary space. The trocar is withdrawn, leaving the open end of the needle directly in the rich vascular network. Various complications, however, have made

15 intraosseous infusion a less than ideal option. Although the needle and trocar assembly have a sharp, pointed tip, the medullary cavity may not be able to be penetrated under normal pressure. Too much force in trying to puncture the bone sometimes results in a bent needle, a broken needle,

20 splintering of the bone, sliding off the bone and puncturing adjacent tissue or, more commonly, the needle is accidentally forced through the opposite side of the bone. If the needle is properly inserted into the medullary cavity, movements by the patient can easily dislodge the

25 needle or cause it to be moved so that the end opening is occluded. These complications commonly arise in cases involving intraosseous infusion of infants and children. For persons older than six, the bones are too hard to successfully perform intraosseous infusion without realizing

30 an extremely high incidence of the above complications. The procedure has therefore typically been limited to children less than six years old and only after several attempts have been made to achieve venous infusion.

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What is needed is an intraosseous infusion device which decreases the incidence and severity of the above described complications, which is easier to insert and which is more stable once inserted.

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Summary of the Invention

Generally speaking, there is provided an intraosseous needle assembly which allows for precise control and placement of the needle during intraosseous infusion  
5 procedures.

An intraosseous needle has a threaded shaft with a passageway extending therethrough. At the leading end of the shaft is a solid, pointed tip having a pair of concave indentations which define four cutting edges. The tip is  
10 adapted for rapid and precise boring into the bone of adults, children or infants. The shaft further defines a pair of side ports, one located in the valley between the leading or first full thread and the second thread and the other side port located between the second thread and the  
15 third thread. The side ports are located 90° apart and are both in communication with the passageway of the shaft. A handle in the shape of a ball knob is adapted for telescopic and gripping connection to the trailing end of the needle and both the handle and the trailing end of the needle are  
20 equipped with mutually engaging, torque-transmitting faces.

It is an object of the present invention to provide an improved intraosseous needle which reduces the incidence and severity of the complications attendant in current procedures and devices.

25 It is another object of the present invention to provide an intraosseous needle which is easy to use.

It is still another object of the present invention to provide an intraosseous needle which is more stable once inserted.

30 Further objects and advantages of the present invention will become obvious from the following description of the preferred embodiment.

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Brief Description of the Drawings

FIG. 1 is a plan view of an intraosseous needle of an intraosseous assembly in accordance with the preferred embodiment of the present invention.

5      FIG. 2 is a fragmented plan view of the needle of FIG. 1 which has been rotated 90° about its axis.

FIG. 3 is a plan view, partly in section, of a handle and intraosseous needle of the intraosseous needle assembly of the present invention.

10      FIG. 4 is a front view of the handle of FIG. 3.

FIG. 5 is a front end view of the intraosseous needle of FIG. 1.

FIG. 6 is a diagrammatic side view of the proximal tibia showing the preferred access site of the present invention.

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Description of the Preferred Embodiment

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now to FIGS. 1 and 2 there is shown an intraosseous needle 10 in accordance with the preferred embodiment of the present invention. Needle 10 includes a hub 11, a threaded shaft 12 and boring means. In the preferred embodiment, the boring means is a fluted pencil point tip 13 and there are sixteen buttress threads 15 per inch on shaft 12. The lead angle or helix angle  $\theta$  is defined as the angle formed by a plane (indicated at 17) drawn tangent to the pitch helix and a plane (indicated at 18) normal to the axis 21 of threaded shaft 12. The leading and trailing thread surfaces are indicated at 18 and 19, respectively. The trailing thread angle  $\alpha$  (not shown) is defined here as that angle formed by a plane (indicated as 20) drawn tangent to trailing thread surface 19 and plane 18 normal to axis 12. Trailing thread angle  $\alpha$  in the preferred embodiment is equal to the helix angle  $\theta$ . That is, plane 17 is parallel to plane 20.

Hub 11, located at the rearward or trailing end of threaded shaft 12, forms the female end for connection to a conventional Luer-type fitting and includes a generally



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cylindrical portion 22 and an annular flange portion 23. A generally cylindrical section 24 is located between cylindrical portion 22 and threaded shaft 12. The diameters of flange portion 23 and cylindrical section 24 are approximately equal and both are greater than the diameter of cylindrical portion 22. Cylindrical section 24 has a pair of diametrically opposed and mutually parallel flat faces 25. Flange portion 23 likewise has a pair of diametrically opposed and mutually parallel flat faces 26 which are coplanar with corresponding flat faces 25. A large diameter bore 29 is defined in hub 11 and extends from end 30 through cylindrical portion 22 and partially through cylindrical section 24. Bore 29 receives the male portion of the Luer-type fitting. A smaller diameter axial passageway 31 is in communication with bore 29 and extends from bore 29 forwardly through nearly the entire length of threaded shaft 12. A pair of side ports 33 and 34 extend radially outwardly from axial passageway 31 near tip 13. Side ports 33 and 34 are located 90° apart. Side port 33 opens outwardly in the valley between the leading or first full thread 36 and the second thread 37. Side port 34 opens outwardly in the valley between the second thread 37 and the third thread 38.

Fluted pencil point tip 13 is substantially conical with the conical outer surface 40 forming an angle  $\Phi$  with axis 21 of approximately 20°. A pair of diametrically opposed flutes 41 and 42 are milled into the end of tip 13 using a ball end mill. The end mill used to cut flutes 41 and 42 is aligned to rotate about an axis which is parallel with axis 21 during the milling process. The foremost end 43 of leading thread 36 is interrupted by the milling process such that leading thread 36 terminates into one of the flutes (42). The milling process thus forms sharp boring edges 44

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and 45 between flute 41 and conical surface 40 and sharp boring edges 46 and 47 between flute 42 and conical surface 40. The border between leading thread 36 and flute 42 likewise forms a sharp cutting edge at 43. As shown in FIG. 1, flute 42 is machined further rearwardly than flute 41. In the preferred embodiment, the complete axial length of flute 41 measured from tip 48 is 0.14 inches while the complete axial length of flute 42 measured from tip 48 is 0.16 inches.

10 A complete intraosseous needle assembly includes, along with intraosseous needle 10, a corresponding gripping means or gripping element which is handle 50 (FIGS. 3 and 4). Handle 50 comprises a plastic ball knob 51 having an axial bore 52. An insert 53 for gripping needle 10 is sized to be 15 tightly received within bore 52. Insert 53 is fixed within bore 52 by appropriate means such as by gluing. Insert 53 is adapted to couple with needle 10 and has a central opening 55 which is generally cylindrical with opposing planar faces 56. Opening 55 is sized to receive the 20 complimentary shape of hub 11 with its cylindrical section 24 and opposing flat faces 25. Insert 53 further includes stub 57 which extends forwardly into opening 55. As hub 11 of needle 10 is received within opening 55, stub 57 enters bore 29 of hub 11. Stub 57 is tapered slightly forwardly 25 such that its largest diameter, at its base 58, is the same as or just slightly larger than the inner diameter of bore 29. As stub 57 advances into hole 29, the larger diameter at base 58 of stub 57 wedges within bore 29 forming a snug fit between needle 10 and handle 50. Hub 11, bore 29, 30 opening 55 and stub 57 are sized to create a mutually snug connection sufficient to cause hub 11 to remain firmly lodged within handle 50 but to be removed under a moderate manually applied tensile force.

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Alternative embodiments are contemplated wherein the gripping means may be a permanently attached handle or other structure suitable for grasping by the person inserting the needle. The gripping means may also be or include some type of mechanical or electromechanical device which provides the necessary twisting and rotating action.

The intraosseous needle assembly is used as follows:

An intraosseous needle 10 is firmly secured to a handle 50. The preferred site is marked and an incision is made in the skin down to the bone. The preferred site 64 is found by first identifying the tibial tuberosity 62 on the anterior surface of the proximal tibia. An imaginary line is drawn from the tibial tuberosity to the median edge of the tibia 61. This line is equally divided 63 and the site of insertion 64 is perpendicular and distal to 63. The preferred site 64 increases in distance from 63 with increasing age. In the newborn or infant this distance may be as short as 0.3 - 0.5 cm and increases to approximately 2.5 cm by 6 years of age. Insertion at the level of the tibial tuberosity or distally, avoids insertion of the needle into the growth place of the tibia. The distal medial tibia is also an excellent site.

With handle 50 firmly in the palm of the operator's hand, the needle is selectively directed toward the desired access site 63 and contact with the bone is made. A back and forth twisting motion with slight pressure causes the four boring edges 44-47 to cut into the bone and enables flutes 41 and 42 to penetrate to the threaded section of needle 10. During the twisting motion, flutes 41 and 42 carry bone fragments out of the hole. Once the lead thread 36 reaches the hole 60, no further pressure is required. The operator simply screws the needle clockwise into the marrow to the desired depth. Obviously the size of the

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patient will determine how far to screw the needle in. As the needle is rotatably advanced, the design of threads 15 directs the marrow out and away from side ports 33 and 34. A fluid injected through needle 10 may then exit through  
5 side ports 33 and 34 unobstructed by marrow or other tissue which otherwise clogs conventional intraosseous needles.

With needle 10 in the desired position, handle 50 may be detached from needle 10 by slight, manually applied, tensile pressure therebetween. The appropriate drug administering  
10 mechanism such as a syringe or I.V. tubing may then be secured via the Luer-type fitting. After the patient has stabilized, venous access may be achieved and needle 10 may be removed by detaching the I.V. tubing or syringe from needle 10 and by re-securing handle 50 thereto. The needle  
15 may then be backed out by turning needle 10 counterclockwise.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred  
20 embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

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## WHAT IS CLAIMED IS:

1. An intraosseous needle, comprising:  
a threaded shaft having first and second opposing ends  
and a passageway extending from the first end toward the  
5 second end;  
boring means for initiating penetration of said shaft  
into bone, said boring means extending forwardly from the  
second end; and  
wherein said shaft has at least one opening proximal to  
10 the second end and in communication with the passageway.
2. The intraosseous needle of claim 1 wherein said  
boring means is generally conical with a pointed tip.
3. The intraosseous needle of claim 2 wherein said  
boring means is solid and has at least two cutting edges.
- 15 4. The intraosseous needle of claim 3 wherein said at  
least one opening is a side port located behind said boring  
means.
5. The intraosseous needle of claim 4 wherein said  
boring means has a pair of concave indentations which define  
20 said at least two cutting edges.
6. The intraosseous needle of claim 5 wherein said  
shaft has a plurality of threads, the thread nearest to said  
boring means being a leading thread and wherein at least one  
of said indentations interrupts the leading thread.
- 25 7. The intraosseous needle of claim 6 wherein there  
are two side ports, each of which is located between two  
adjacent threads.

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8. The intraosseous needle of claim 6 wherein said indentations define four cutting edges which enable said needle to cut into bone by rotating said needle in any direction about said axis.

5        9. The intraosseous needle of claim 6 wherein each of said threads has a helix angle and a trailing angle, the trailing thread angle and helix angle being substantially equal.

10       10. The intraosseous needle of claim 6 wherein said pair of concave indentations create four cutting edges, two of said four cutting edges for cutting upon rotation of said shaft in one direction about the axis and the other two of said four cutting edges for cutting upon rotation of said shaft in a direction opposite to the one direction.

15       11. An intraosseous needle assembly, comprising:  
an intraosseous needle having a threaded shaft having first and second opposing ends and a passageway extending from the first end toward the second end, wherein said shaft has at least one opening proximal to the second end and in  
20 communication with the passageway;

boring means extending from the second end and for initiating penetration of said shaft into bone;

first coupling means at the first end for coupling with a gripping element; and

25       a gripping element having a handle and second coupling means for coupling with said first coupling means.

12. The intraosseous needle assembly of claim 11 wherein said boring means is generally conical with a pointed tip.

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13. The intraosseous needle assembly of claim 12 wherein said first and second coupling means both have mutually engageable torque transmitting means for transmitting torque between said gripping element and said  
5 needle.

14. The intraosseous needle assembly of claim 13 wherein said boring means is solid and has at least two cutting edges.

15. The intraosseous needle assembly of claim 14  
10 wherein said at least one opening is a first side port located behind said boring means.

16. The intraosseous needle assembly of claim 15 wherein said shaft has a plurality of threads, including a leading thread proximal to said boring means, a second  
15 thread adjacent to the leading thread, and a third thread adjacent to the second thread, wherein said boring means has a pair of concave indentations which define said at least two cutting edges and wherein at least one of said indentations interrupts the leading thread.

20 17. The intraosseous needle assembly of claim 16 wherein there is a second side port in communication with the passageway and wherein said first side port is located between the leading thread and the second thread, wherein said second side port is located between the second thread  
25 and the third thread, and wherein said first and second side ports are 90° apart.

18. The intraosseous needle assembly of claim 17 wherein said torque transmitting means of said first

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coupling means is a generally cylindrical section having diametrically opposed and mutually parallel planar faces, and wherein said torque transmitting means of said second coupling means is a generally cylindrical central opening  
5 defining a pair of diametrically opposed and mutually parallel faces, said central opening sized to telescopically receive said generally cylindrical section.

19. The intraosseous needle assembly of claim 18 wherein said handle is an ovally shaped ball knob.

10 20. A method for preparing a patient for intraosseous infusion at a preferred site of the patient's bone, comprising the steps of:

providing an intraosseous needle having a threaded shaft having first and second ends, a passageway extending from  
15 the first end toward the second end, an axis, at least one opening proximal to the second end and in communication with the passageway, and a first thread proximal to the second end;

providing boring means at the second end for initiating  
20 penetration of said needle into bone;

positioning said boring means against the bone at the preferred site;

initiating penetration of said needle into the bone by applying axial pressure to said needle, forcing said boring  
25 means into the bone until the first thread is at the hole; and,

screwing the needle into the hole by appropriately rotating said needle about its axis until said side ports are through the hole.



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21. The method for preparing a patient for intraosseous infusion of claim 20 wherein said boring means is generally conical with a pointed tip, said boring means defining a plurality of cutting edges.

5 22. The method for preparing a patient for intraosseous infusion of claim 21 wherein said initiating penetration step includes twisting said needle back and forth while applying axial pressure.

23. The method for preparing a patient for intraosseous  
10 infusion of claim 20 further including providing gripping means for coupling and gripping the first end of said needle.

24. The method for preparing a patient for intraosseous infusion of claim 20 wherein said at least one opening includes a first side port and a second side port.

15 25. The method for preparing a patient for intraosseous infusion of claim 24 further including detaching said gripping means from said needle and connecting an appropriate infusion delivering element after said screwing step.

20 26. The method for preparing a patient for intraosseous infusion of claim 24 wherein said providing an intraosseous needle step includes preparing the second end by forming the second end into a substantially conical shape and by end milling the second end with a ball end mill to create a pair  
25 of concave indentations, said indentations defining a plurality of cutting edges.

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27. The method for preparing a patient for intraosseous infusion of claim 26 wherein said threaded shaft includes a second thread adjacent to said first thread and distal from the second end and includes a third thread adjacent to said  
5 second thread and distal from said first thread and wherein said first side port opens outwardly between said first and second threads and said second side port opens outwardly between said second and third threads.

28. The method for preparing a patient for intraosseous  
10 infusion of claim 27 wherein said first and second side ports are 90° apart.

29. The method for preparing a patient for intraosseous infusion of claim 28 further including the step of making an incision in the patient's skin down to the bone at the  
15 preferred site, said making an incision step to be performed before said grasping step.

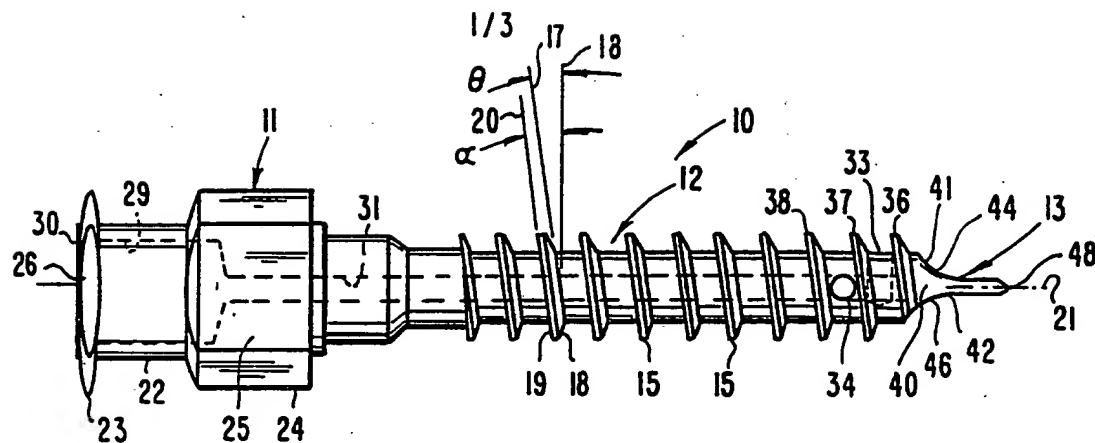


Fig.1

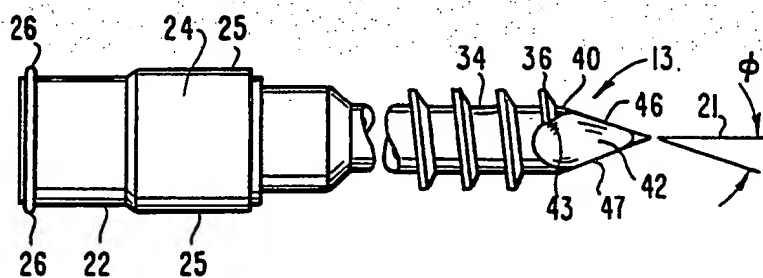
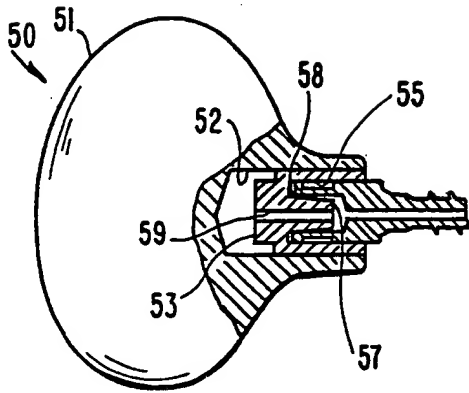
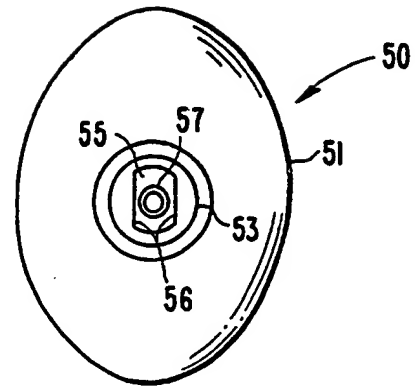


Fig.2

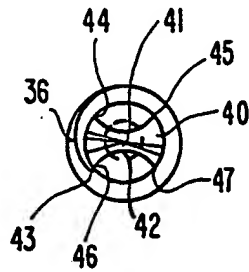
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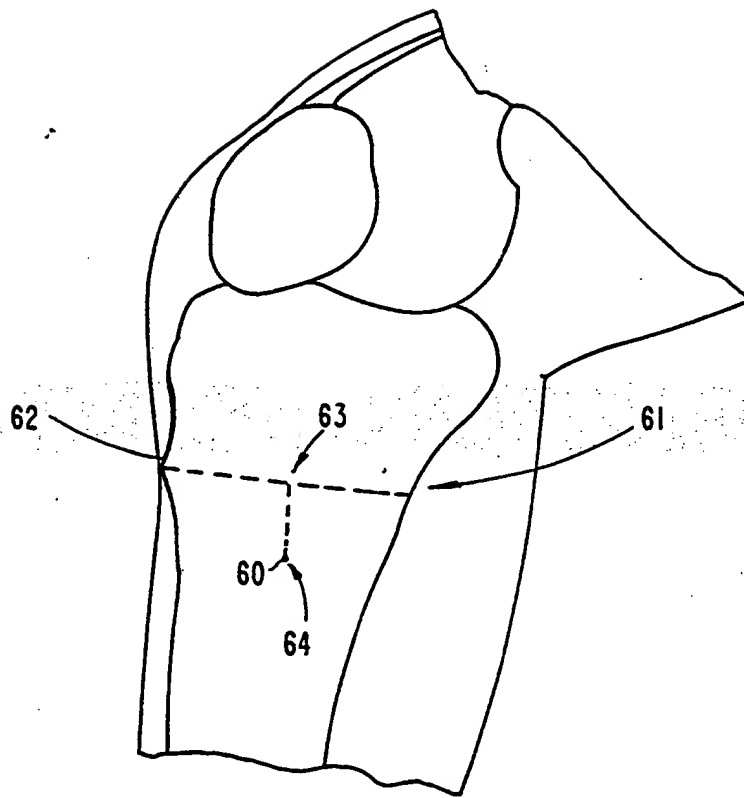
**Fig. 3**



**Fig. 4**



**Fig. 5**



**Fig.6**

# INTERNATIONAL SEARCH REPORT

International Application No PCT/US 89/04715

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC IPC <sup>5</sup> :      A 61 B 17/34		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC <sup>5</sup>	A 61 B, A 61 M	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b>		
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	US, A, 3750667 (PSHENICHNY et al.) 7 August 1973 see column 2, line 59 - column 3, line 7; figures 1-5	1-4,11-15
Y	--	5
Y	US, A, 2525329 (WYZENBECK A.) 16 September 1948 see column 2, lines 22-28, figure 7	5
A	GB, A, 2130890 (DOWNS SURGICAL) 13 June 1984 see page 4, lines 14-21, 76-103; figures 1-5	7,8,10,17, 19
A	DE, C, 265433 (FIRMA WINDLER H.) 1 December 1912 see page 1, lines 5-15	9
A	FR, A, 2138152 (N.V. PHILIPS) 29 December 1972	-----
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
22nd January 1990	22.02.90	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 T.K. WILLIS	

**FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET**

**V. ☒ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE <sup>1</sup>**

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☒ Claim numbers XX, because they relate to subject matter not required to be searched by this Authority, namely:

XX 20 - 29

pls. see Rule 39.1 (iv) - PCT :

Method for treatment of the human or animal body by surgery or therapy as well as diagnostic mehtods.

2. ☐ Claim numbers \_\_\_\_\_, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers \_\_\_\_\_, because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

**VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING <sup>2</sup>**

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

**Remark on Protest**

- ☐ The additional search fees were accompanied by applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

US 8904715

SA 32186

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 16/02/90. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3750667	07-08-73	None	
US-A- 2525329		None	
GB-A- 2130890	13-06-84	None	
DE-C- 265433		None	
FR-A- 2138152	29-12-72	AU-B- 459997	10-04-75
		AU-A- 4233072	22-11-73
		BE-A- 783638	17-11-72
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		DE-A- 2224024	07-12-72
		GB-A- 1324759	25-07-73
		NL-A- 7106896	21-11-72
		SE-B- 375446	21-04-75
		US-A- 3815605	11-06-74
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